

Govt. Doc
Can.

SG

Canada - Geodetic Service

DEPARTMENT OF THE INTERIOR, CANADA

HON. THOMAS G. MURPHY, Minister

H. H. ROWATT, C.M.G., Deputy Minister

GEODETIC SURVEY OF CANADA

NOEL J. OGILVIE, Director



3 1761 120004437

ANNUAL REPORT

OF THE DIRECTOR

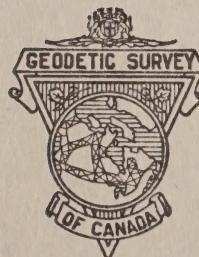
OF THE

GEODETIC SURVEY OF CANADA

FOR THE

FISCAL YEAR ENDING MARCH 31, 1933

1932/33



OTTAWA
J. O. PATENAUME
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1934

DEPARTMENT OF THE INTERIOR, CANADA

HON. THOMAS G. MURPHY, Minister

H. H. ROWATT, C.M.G., Deputy Minister

GEODETIC SURVEY OF CANADA

NOEL J. OGILVIE, Director

ANNUAL REPORT

OF THE DIRECTOR

OF THE

GEODETIC SURVEY OF CANADA

FOR THE

FISCAL YEAR ENDING MARCH 31, 1933

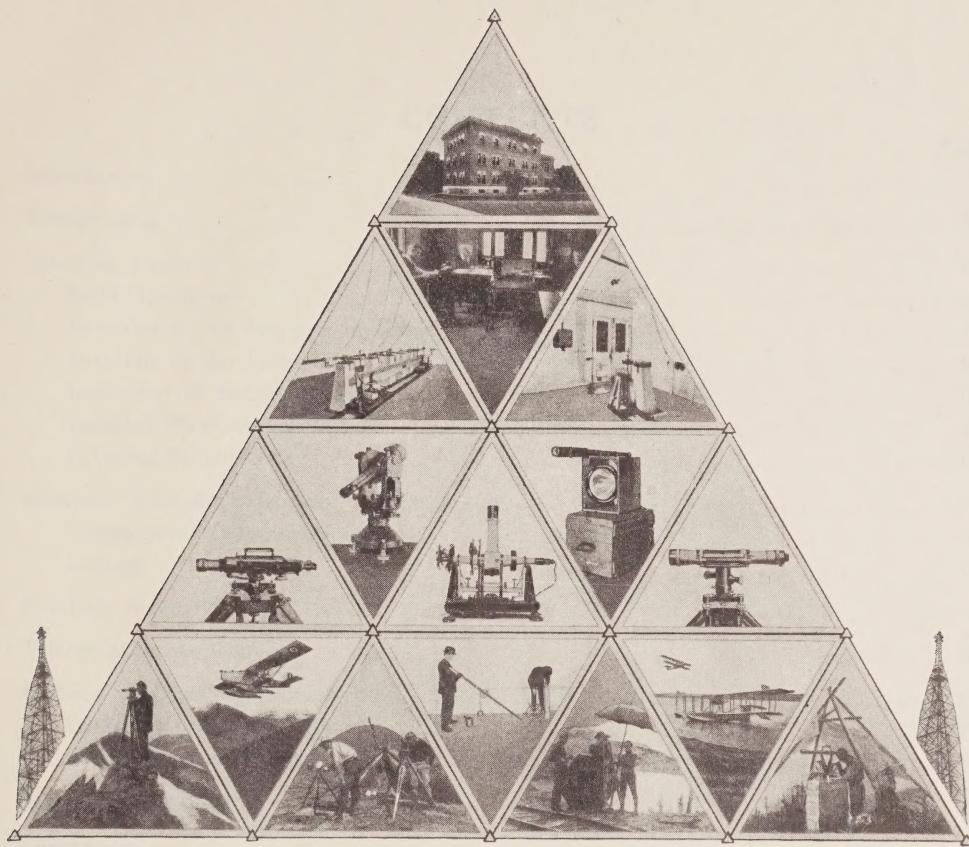


OTTAWA

J. O. PATENAUME

PRINTER TO THE KING'S MOST EXCELLENT MAJESTY

1934



OPERATIONS OF THE GEODETIC SURVEY OF CANADA

Top—Geodetic Survey Building at Ottawa.

Second row, left to right—

North end of Standard building, showing five-metre apparatus.

Office of Precise Level Adjusting Division.

Fiducial point at south end of 50-metre comparator, in Standard building.

Third row, left to right—

Precise Level, U.S.C. & G.S. Pattern.

Latest Model Primary Triangulation Model theodolite.

Latest Model Astronomical Transit.

Electric Signal Lamp for Primary Triangulation.

Precise Level, Zeiss Model.

Bottom row, left to right—

Observing on Secondary Triangulation.

Photographic and Transport Hydroplane, Canadian model.

Sending instructions to light keepers by heliograph.

Setting rear end of tape in Base-line measurement.

Observing Precise Levels in the Yukon Territory.

A Transport Hydroplane at rest.

Observing Primary Triangulation.

On flanks—

Triangulation Tower near Chatham, Ont., with Lamp-stand extended 37 feet. Height of Lam-stand: 147 feet.

CONTENTS

	PAGE
Introduction	7
Triangulation	10
Levelling Division	10
Field Operations	10
Levelling in the Province of Ontario.....	10
Levelling in the Province of Nova Scotia.....	10
Inspection of Bench Marks.....	13
Detailed Statement of Mileage ² of Levelling Run in 1932.....	13
Levelling Publications	13
Geodetic Astronomy, Isostasy and Base Lines.....	15
Geographical Determinations	15
Isostasy	15
Geodetic Research	15
Triangulation Adjustments	16
Division of Levelling Adjustments.....	17
Precise Levelling Adjustments	17
Investigation into Weighting	17
Mechanical Physics	19
Publications	19
Locality of Field Operations.....	19
List of Publications of the Geodetic Survey of Canada.....	20

ILLUSTRATIONS

ENGRAVINGS

Operations of the Geodetic Survey of Canada.....	3
Typical Canadian Lake and Forest Country.....	8
Stereoscopic Oblique Photographs Determine Intervisibility of Hills.....	9

LINE CUTS

Triangulation to March 31, 1933.....	11
Precise Levelling to March 31, 1933.....	12
Deflection of the Plumb Line, 1933.....	14
Precise Levelling Graph	18

Digitized by the Internet Archive
in 2024 with funding from
University of Toronto

THE GEODETIC SURVEY OF CANADA

ANNUAL REPORT OF THE DIRECTOR, NOEL J. OGILVIE

INTRODUCTION

The operations of the Geodetic Survey of Canada, Department of the Interior, comprise primary triangulation, triangulation reconnaissance, precise levelling, geodetic astronomy, triangulation base-line measurement, isostasy, geodetic research, triangulation adjustment, precise levelling adjustment, testing new types of geodetic instruments, and the publication of geodetic survey data.

Field parties carried on geodetic operations in the provinces of Ontario, Quebec, and Nova Scotia.

As in previous years, requests for geodetic control data have been received by this Survey from federal departments, provincial departments, municipalities, corporations, and the engineering and surveying public, and in response the most recently determined data were supplied.

Progress in the adjustment of geodetic triangulation made it possible to complete a series of publications of this Survey, giving adjusted values for triangulation results extending from the Great Lakes to the Atlantic ocean.

During the past year the first of a series of publications, which will eventually form the third edition of "Altitudes in Canada," was released and distributed. In this edition the altitudes rest for the first time on the solid foundation of a national precise level system which has been simultaneously adjusted in its entirety.

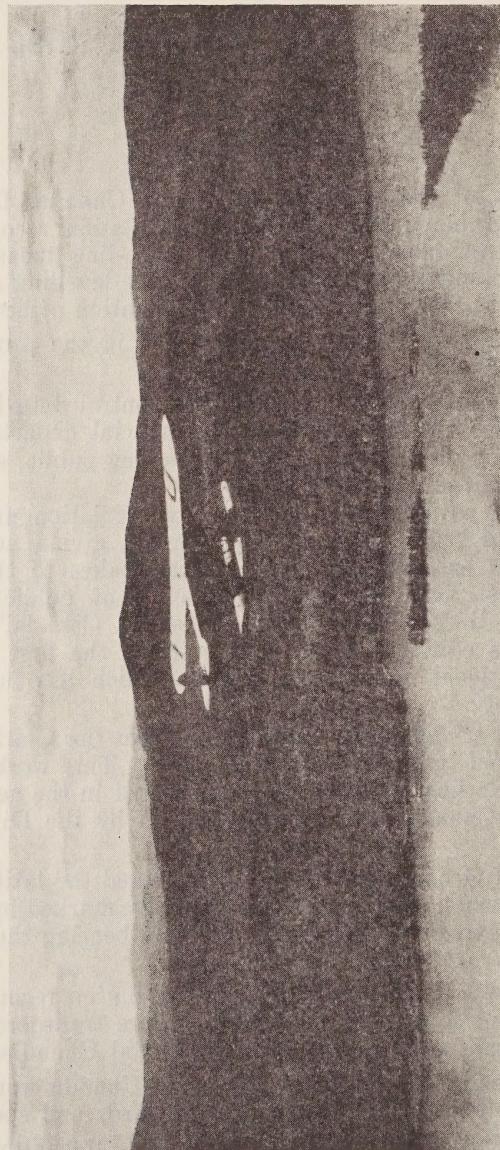
The transfer of triangulation adjustment from the Clarke spheroid to the International ellipsoid has necessitated research. This work and the investigation of the geodetic line for distances encountered in the geodetic survey of a country as vast as Canada have been carried on by the Division of Geodetic Research.

The Division of Geodetic Astronomy determined the latitude and longitude of several frontier points. These were permanently marked in the usual manner with concrete piers extending below the frost line bearing the bronze tablets of the Geodetic Survey of Canada.

Aeroplane transportation required for triangulation reconnaissance and for moving engineers and equipment in districts where transport was difficult was made possible through co-operation with the Royal Canadian Air Force.

Five publications of the Geodetic Survey of Canada were printed and are now being distributed by means of notification cards and special mailing lists.

Canada's contribution to the "Reports of the International Association of Geodesy" has been printed. A sufficient number of copies for binding with the international reports will be forwarded to Paris, France. Copies required for the members of the International Association of Geodesy on the occasion of the Fifth General Conference of the International Geodetic and Geophysical Union in 1933 will be forwarded to Lisbon, Portugal.



Typical Canadian Lake and Forest Country



Stereoscopic Oblique Photographs Determine Intervisibility of Hills

TRIANGULATION

During the season of 1932, as in 1931, triangulation operations were conducted on a less extensive scale than in previous years. No new nets were started; only such work was projected as was required to complete certain loops or circuits of triangulation, so that the maximum of adjustment work could be carried on with the minimum field expenditure and the results published with the least loss of time.

Field work was carried on in two areas—one in the northern Gatineau River net and one along the northern line of the Canadian National Railways in the province of Quebec. These operations completed the field work on three large loops in western Quebec. One new station was occupied. Aeroplanes were exclusively employed for the transportation of the parties in one of the areas; in the other area a plane was used for part of the work.

Opportunity was taken of the small field program in 1932 to initiate a thorough test of the type of light $5\frac{1}{2}$ -inch theodolite used since 1928 for primary triangulation in Canada. Comparative tests were made during the summer of 1932 between the light type and two heavier theodolites which had given first class results over a period of years. When the winter weather made further outdoor tests impossible a different series of tests was conducted in the National Research Council laboratories on collimators.

Valuable data resulted from these tests, though no report on the results can yet be made available on account of their incompleteness. Further tests are being conducted to complete the light theodolite comparisons initiated in 1932 and to further explore the influence of observers' varying personal equation of pointing on angular measurements in triangulation systems.

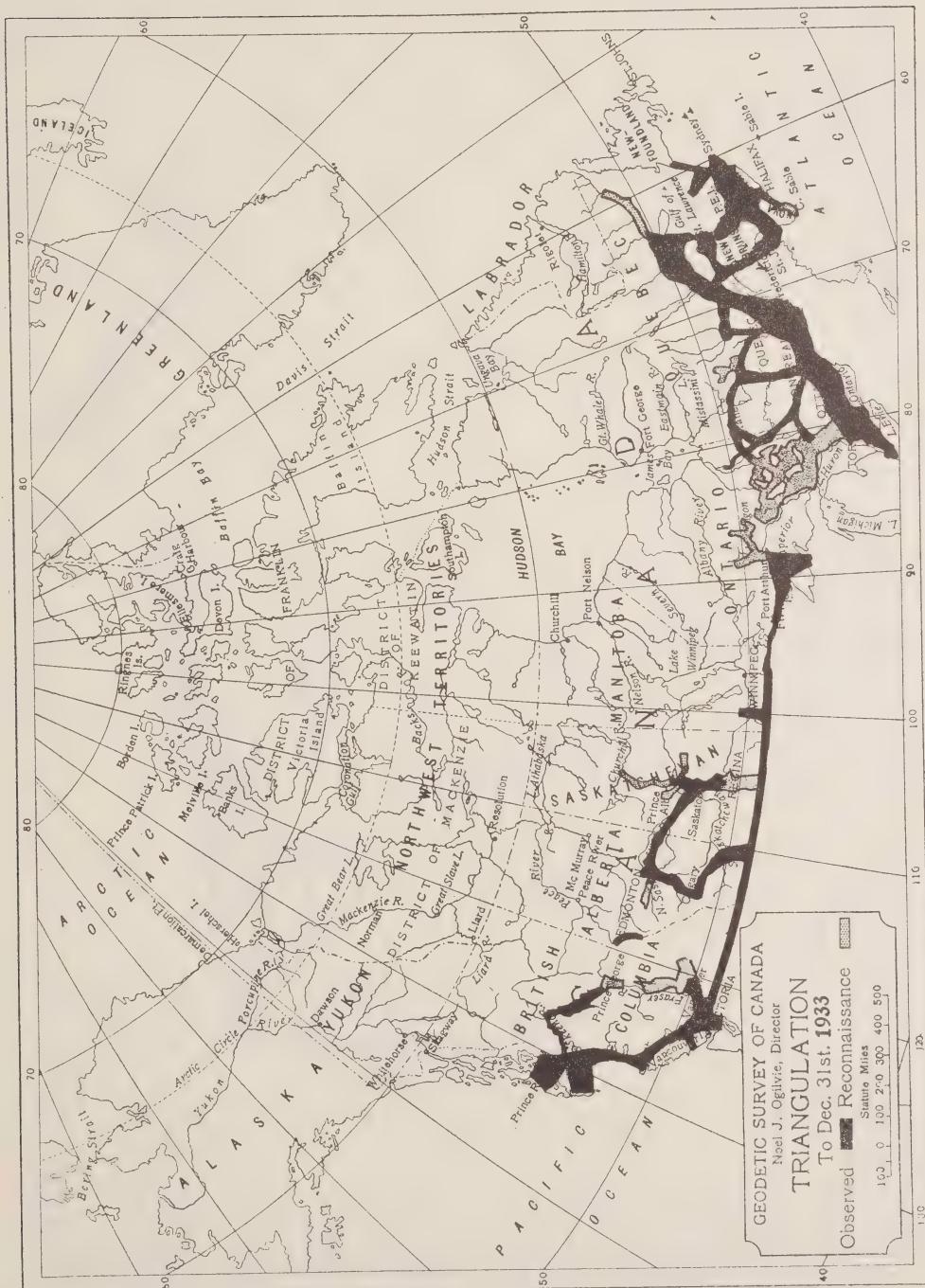
LEVELLING DIVISION

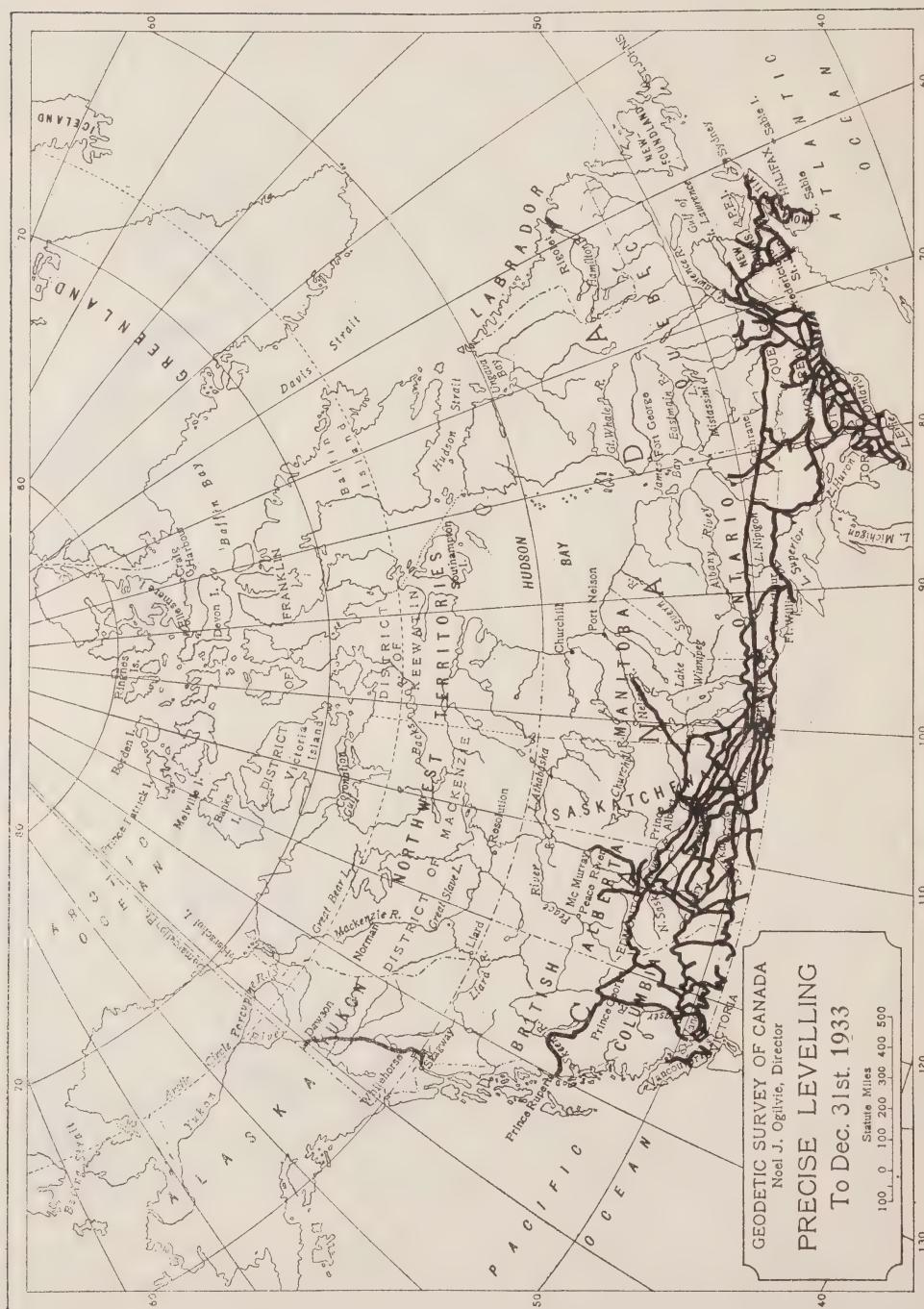
Field Operations.—Levelling operations were carried out in the year 1932 in only two provinces—Ontario and Nova Scotia. The work in Ontario was partly precise and partly secondary levelling, while in Nova Scotia a special party was engaged in establishing fundamental bench marks.

Levelling in the Province of Ontario.—The first work undertaken was a line of precise levels from Glencoe southeasterly to a point on the Fort Erie-Windsor highway, thence along the highway to Blenheim and thence northwesterly to Chatham. This levelling was done primarily for the purpose of co-ordinating the Department of Public Works levelling in the district with the Geodetic Survey system. A retracement of the original levelling along the Canadian National railway between Chatham and Glencoe, a distance of 36 miles, run many years ago, was also included. Fourteen additional bench marks were established during the course of the work in the district, including one fundamental bench mark at Bothwell.

After the completion of this work secondary levelling was carried out in the counties of Durham, Victoria, and Peterborough, this being a continuation of the levelling in adjoining areas during the past three years. Lines of levels were extended from Newcastle to Lindsay and Peterborough and northerly from the latter point through Burleigh Falls, Buckhorn, and Goodeham.

Levelling in the Province of Nova Scotia.—In Nova Scotia fourteen fundamental bench marks were established. Additional standard bench marks were established in several of the cities or towns at which fundamentals were constructed. The standard bench marks are, for the most part, in public buildings of a permanent nature erected subsequent to the original levelling. Fundamentals were established at the following places: Antigonish, Barrington Passage, Bridgewater, Chester, Halifax, Kentville, Liverpool, Middleton, Shelburne, Sydney,





Truro, Windsor, Wolfville, and Yarmouth. Bench marks of the bronze plate type were set in prominent positions on four of the leading hotels of the province, namely, the "Nova Scotian" and "Lord Nelson" at Halifax, the "Cornwallis Inn" at Kentville, and the "Isle Royale" at Sydney. These plates measure $7\frac{1}{4}$ inches in the horizontal and $3\frac{1}{2}$ inches in the vertical and have the name of the Survey cast in large type, the elevation being engraved in a space provided for it.

Inspection of Bench Marks.—The work of inspecting and redescribing bench marks taken over from the levelling system of the Department of Public Works was continued during 1932, the districts covered including the Essex peninsula in southwestern Ontario, the St. Lawrence river between Prescott and Montreal, and several lines in the vicinity of St. Johns, Quebec. Nearly 800 bench marks were visited in the above areas during the course of the season.

Mileage of Levelling.—The mileage of precise and secondary levelling at the end of the fiscal year 1932-33 is shown in the following tables:—

DETAILED STATEMENT OF LEVELLING

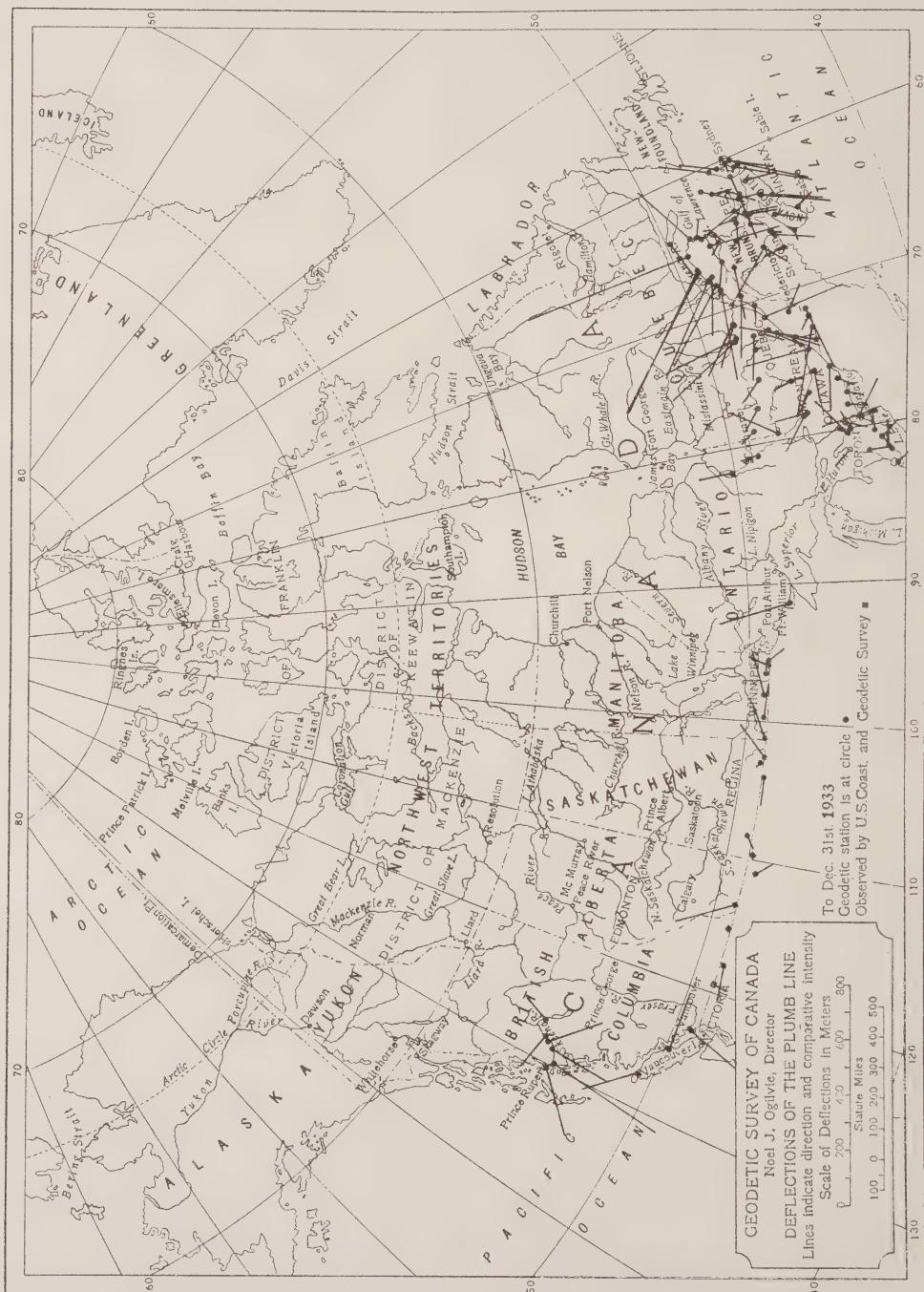
	Precise levelling			Secondary levelling		
	Prior to 1932	1932	Total	Prior to 1932	1932	Total
Nova Scotia.....	729		729			
New Brunswick.....	1,096		1,096			
Quebec.....	3,418		3,418	640		640
Ontario.....	5,866	62	5,928	1,134	120	1,254
Manitoba.....	2,263		2,263	368		368
Saskatchewan.....	4,113		4,113	5,098		5,098
Alberta.....	2,866		2,866	3,795		3,795
British Columbia.....	3,655		3,655	120		120
Yukon.....	458		458			
Minnesota (U.S.A.).....	89		89			
Vermont (U.S.A.).....	6		6			
	24,559	62	24,621	11,155	120	11,275

SUMMARY OF LEVELLING AND BENCH MARKS

Precise levelling	Miles	Bench marks	Secondary levelling	Miles	Bench Marks
Prior to 1932.....	24,559	8,594	Prior to 1932.....	11,155	3,837
1932.....	62	38	1932.....	120	54
Total.....	24,621	8,632	Total.....	11,275	3,891

Sixty-two miles of precise levelling, and all but 16 miles of the secondary levelling which was along the Canadian Pacific railway, were carried out on highways or country roads.

Publications.—During the year the first of a series of publications on altitudes was printed and distributed. This series of publications, when completed, will constitute the third edition of "Altitudes in Canada." The first edition of "Altitudes in Canada," by the late Mr. James White, was published in 1901. The second edition was issued in 1915 by Mr. White and appeared as a publication of the Commission of Conservation. In that edition it is of interest to note that some 1,000 elevations were given for the entire province of Saskatchewan.



Geodetic Survey of Canada Publication No. 47—"Altitudes in Saskatchewan South of Latitude $51^{\circ} 30'$ "—contains 82 pages and gives elevations for some 8,500 topographical features. The text is prepared in dictionary form with descriptions and altitudes of features tabulated under the name of the nearest railway station. The purpose of this publication is twofold: first, to place at the disposal of the general public a compendium of altitudes in an accessible form for ready reference; second, to supply the engineering profession with reliable elevations for points which may be definitely located on the ground and which may serve as starting points for local surveys or development projects and enable such to be placed on mean sea-level datum.

The manuscript for the companion publication, namely, "Altitudes in Saskatchewan North of Latitude $51^{\circ} 30'$," which has been completed but not printed, will contain approximately the same number of altitudes as are found in Publication No. 47.

GEODETIC ASTRONOMY, ISOSTASY, AND BASE LINES

Geographical Determinations.—For the purpose of determining the longitude and latitude of stations in Yukon Territory a geodetic astronomic survey party was sent to the Territory in the month of June, 1932. Five stations, namely, McGregor Creek, Hootalinqua, Big Salmon, Upper Laberge, and Pennington were observed. These values of longitude and latitude are being used by the Topographical Division of the Geological Survey to control its secondary triangulation and traverse. The station at Pennington is nearly coincident with a latitude station determined by the surveyor who established the Yukon-British Columbia boundary line (the 60th parallel) and the agreement between the two values of latitude is very close.

The wireless method of longitude is now used exclusively on all geodetic survey astronomical work. For the Yukon work the observer was equipped with long wave and short wave sets. After repeated trials with both sets, it was found that the reception on the short wave receiver was good while on account of atmospheric conditions the reception on the long wave set was so poor that no time signals were received. Consequently, at all stations the short wave set was employed, and gave complete satisfaction.

Isostasy.—In connection with further investigations on the subjects of isostasy and deflection of the vertical, nine geodetic stations in the province of Nova Scotia were occupied for longitude and latitude determinations. These are: Camden, Antigonish, Mabou, Ingonish, Lynk, L'Ardoise, Western Head, Little River, and Aylesford.

During the past year, in conjunction with the adjustment division, considerable investigation has been made to determine the extent to which the observed deflections of the vertical are related to the topography. The result of this preliminary investigation is to show that probably thirty more observations are needed in the Maritime Provinces before it will be feasible to proceed with a final solution. Also in Quebec and Ontario an additional number of observations are necessary. There is, however, no field of geodetic research that gives greater returns for the same expenditure.

GEODETIC RESEARCH

During the past year, additional research has been directed toward a solution of the problem of transferring the results of triangulation adjustments from the Clarke to the International ellipsoid. This work has been made necessary as a result of the decision of the International Geodetic and Geophysical Union to adopt the International ellipsoid as the standard of reference for all countries conducting geodetic operations.

Also, further investigations have been made in connection with the direct and inverse solutions of long geodetic lines.

TRIANGULATION ADJUSTMENTS

The work of this division during the last year has been largely a continuation of the publication program outlined in previous reports. The publication for the area covering southwestern Ontario, from Belleville westerly to Collingwood and Windsor, was printed and distributed. The publication for the St. Lawrence River valley, easterly from Montreal to Anticosti island has been printed and is now available for distribution.

The above program now makes available in printed form the results of the triangulation of the Geodetic Survey of Canada for a continuous area immediately adjacent to the international boundary, from near Windsor, Ontario, easterly to Cape Breton, Nova Scotia, and southwestern Newfoundland. This triangulation has been broken up into convenient units for adjustment, resulting in the following list of publications with the respective areas covered:—

No. 29. "Triangulation in Southwestern Ontario." Area: Westerly from Belleville to lake Huron and northerly from lake Erie to Georgian bay.

No. 30. "Triangulation in New Brunswick and Nova Scotia." Area: From the western end of the bay of Fundy easterly to Amherst and Truro, N.S., thence southerly to Halifax, thence southwesterly to Liverpool and northerly to Caledonia, N.S.

No. 31. "Triangulation in Quebec and New Brunswick." Area: Chaleur bay from the eastern extremity of the Gaspe peninsula to slightly west of Campbellton, N.B., thence northerly to the St. Lawrence river near Mont Joli, Quebec.

No. 32. "Triangulation in New Brunswick and Prince Edward Island." Area: The eastern and western limits of New Brunswick, Northumberland strait, the western and Charlottetown areas in Prince Edward Island.

No. 33. "Triangulation in Eastern Nova Scotia, Magdalen Islands, and Southwestern Newfoundland." Area: Nova Scotia easterly from Truro to Sydney, thence northerly to Money Point, with extensions to the Magdalen islands and southwestern Newfoundland.

No. 34. "Triangulation in Quebec." Area: Easterly from Montreal along the St. Lawrence River valley to Anticosti island and the eastern extremity of the Gaspe peninsula.

No. 35. "Triangulation Closure in the Maritime Provinces: Latitude and Longitude Nomograms." A statement of the methods employed in the adjustment of the main framework, also the construction of latitude and longitude nomograms used in the revision of geographic positions.

No. 2. "Adjustment of Triangulation in the Provinces of Ontario and Quebec." Area: From near Belleville easterly to Montreal, north of lake Ontario and on both sides of the St. Lawrence river.

Publication No. 2, is no longer available for distribution to the public. It is proposed to revise the results of this area by including the results of triangulation which has since been added throughout the net, particularly the large control survey within the Montreal area. The entire matter has now been adjusted and the manuscript is in course of preparation.

Nets of the Canadian primary triangulation bordering on the international boundary have been readjusted on the new framework obtained from a consideration, as a unit, of the primary triangulation of Eastern Canada and Northeastern United States east of a line from Buffalo to New Jersey. These revised results are available to the International Boundary Commission and will serve to harmonize their triangulation upon the new basis, thus making it possible to co-ordinate the work of three organizations contiguous to the boundary line.

A preliminary study of the geoid, or earth's form, for the adjustment of triangulation in Gaspe, New Brunswick, Nova Scotia, and Prince Edward Island was undertaken and carried out successfully. The calculation of the geodetic latitudes and longitudes for the triangulation stations is based upon a spheroid of reference—a purely mathematical surface—whereas the latitudes and longitudes may also be obtained astronomically. The results of the two methods do not, in general, agree within the limits of observation, simply because at any point on the earth's surface the normal to the spheroid, which is a mathematical mean of the earth's form, is not coincident with the direction of gravity.

or that of the plumb line. The geoid surface, unlike the smooth surface of the spheroid, is irregular, with protuberances and depressions and is everywhere perpendicular to the direction of gravity. Its form is that which would coincide with the surface of the waters of the sea if they were allowed to penetrate the land masses by means of narrow canals.

Owing to the scarcity within the area of triangulation stations which are also astronomically observed stations, the result obtained may be considered to represent the geoid-form in its major aspects only. These may be briefly enumerated as follows:—

- (a) Closed circuits of contours for the areas of Gaspe peninsula and Cape Breton island, indicating, although not coincident with, the major topographical reliefs.
- (b) A well marked geoid rise of some 5 metres from western New Brunswick easterly and extending through Prince Edward Island into the gulf of St. Lawrence, with a similar, though sharper, rise from the southerly coast of Nova Scotia into Cape Breton and the same area of the gulf.
- (c) Topographically: Relations for the mountain formations are well defined as are the coastal lines of the provinces, except for the bay of Fundy. The contours southerly from the St. Lawrence river run parallel to the southern shore, and the low terrain of eastern New Brunswick is clearly marked as a flat slope on the geoid.

It is hoped from the knowledge gained in the preliminary investigation to augment the information by a selection of stations for astronomic work, distributed with regard to the existing density of stations and also wherever possible to arrange the locations over various geological formations.

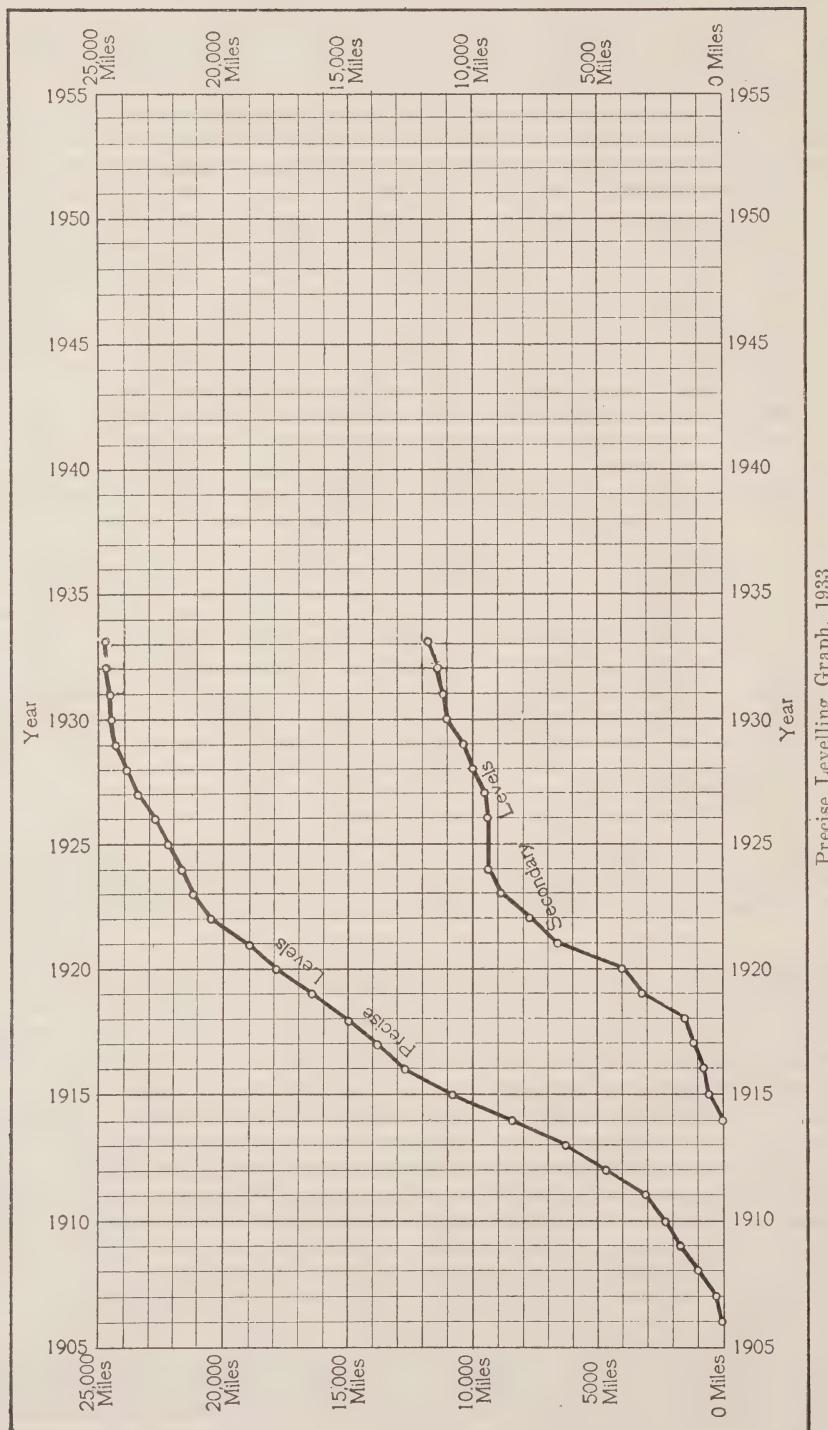
Various demands for geographic positions from other Government bureaus, engineering corporations, and private individuals have been received and the information compiled and forwarded. These demands are constantly increasing in number and reflect an increasing use of geodetic work as control in other survey operations.

DIVISION OF LEVELLING ADJUSTMENTS

The work of the division for the year 1932 may be summarized as relating to precise level adjustment, investigation with weighting continued, and adjustment of observations of nets of levelling done by the Department of Public Works.

Precise Level Adjustment.—This adjustment of the precise level net of Canada not only includes all field work of the Geodetic Survey and the Topographical Survey, but has for its basis only those tidal stations which are thoroughly reliable. Unlike the earlier adjustments, the elevation of Rouses Point—originally agreed on internationally as a held point—is not held in this case on account of the changes in its assigned elevation by the U.S. Coast and Geodetic Survey. It is unlike the last previous adjustment in that the elevation of Squamish on the Pacific coast is not held, as its determination as a tidal station is not considered as reliable as the others. The method of weighting is the same as the others— inversely as the length of the lines. Rouses Point, the held elevation of which in the "1928" adjustment was 108.1500 feet, receives the elevation 108.0783 feet in this adjustment. Squamish, the trial elevation of which was 7.5880 feet, now is given the elevation of 7.6095 feet.

Investigation into Weighting.—Further investigation into the question of weighting observations was made. Only one more adjustment was made during this time, but the question will be taken up later when more important matters have been dealt with.



Adjustment of Nets of Levelling Done by the Department of Public Works.—There are three of these nets, the adjustments of which are nearly completed. The first net comprises the region lying in eastern Ontario and Quebec as far as the city of Montreal: lines XIV, XVII to XXV, and part of line XXXIV, are involved, and a total of twenty conditions are contained in the adjustment. Orthometric corrections have been applied to each line in all Public Works levelling, and the adjustments have been made in such a manner as to hold all points of the precise level net of Canada as adjusted in the "1928" and later adjustments, the elevations held being those found in the publications issued by the Geodetic Survey of Canada.

The second net is a small one of five conditions, the circuits being in the near vicinity of Montreal, running east to St. Hilaire and south to St. Johns. Public Works lines XXIII, XXVII, XXIX, XXX, and XXXVII are involved.

The third net is a larger one comprising the region from Montreal East to the city of Quebec. There are twenty-two circuits involved and, as before, the adjustment is based on elevations of the precise level net as published. Public Works lines in this region are XXXI to XXXVI.

MECHANICAL PHYSICS

The Drafting Section prepared drawings for 11 line cuts and 11 coloured maps; made 15 tracings of geodetic operations; hand printed 302 titles and engraved 62 pieces.

The Woodworking Section completed operations entailed in 42 requisitions including construction and repairs of 67 pieces.

The Section of Instruments and Field Equipment renovated 198 cases for instruments, lamps and time switches; tested 24 new signal lamps; examined 30 tents for alterations and repairs; repaired outboard motors, handled 788 entries of freight and express; checked and recorded stock.

Further material for "A Quarter Century History of the Geodetic Survey of Canada" was compiled.

PUBLICATIONS

The publications of the Geodetic Survey of Canada printed during the fiscal year are: No. 29, "Triangulation in Southwestern Ontario;" No. 34, "Triangulation in Quebec;" No. 47, "Altitudes in Saskatchewan South of Latitude 51° 30'"; "Annual Report of the Director of the Geodetic Survey of Canada for the Fiscal Year ended March 31, 1932;" "Geodetic Operations in Canada, January 1, 1930, to December 31, 1932" (Publication No. 53); Reports of the International Association of Geodesy, The International Geodetic and Geophysical Union, Fifth General Conference, Lisbon, 1933; magazine articles and broadcast talks. Notification cards and specially selected mailing lists were used.

LOCALITY OF FIELD OPERATIONS OF THE GEODETIC SURVEY OF CANADA DURING THE FISCAL YEAR ENDED MARCH 31, 1932

TRIANGULATION

Northern Quebec Primary Triangulation.

LEVELLING

Ontario Precise Levelling.

Nova Scotia Construction of Fundamental Bench Marks.
Reconstruction of Standard Bench Marks.

GEODETIC ASTRONOMY AND ISOSTASY

Yukon Territory Geographical Determinations.

Isostasy Nova Scotia.

PUBLICATIONS OF THE GEODETIC SURVEY OF CANADA

Publication No.

3—Determination of the Lengths of Invar Base Line Tapes from Standard Nickel Bar No. 10239.

5—Field Instructions to Geodetic Engineers in Charge of Direction Measurement on Primary Triangulation.
Instructions to Lightkeepers.

8—Field Instructions for Precise Levelling.

11—Geodesy.

12—Mathematical Statistics of the Geodetic Survey of London, Ont. (Distributed at London, Ont.).

14—Levelling, Co-ordination of Elevations of Bench Marks in the City of Calgary, Alberta.

15—Levelling. Bench Marks Established along Meridians, Base Lines and Township Outlines in Saskatchewan.

16—Levelling. Precise Levelling in Nova Scotia, New Brunswick and Prince Edward Island.

17—Levelling. Precise Levelling in Quebec South of St. Lawrence River.

18—Levelling. Precise Levelling in Quebec North of St. Lawrence River.

19—Levelling. Precise Levelling in Ontario South of Parry Sound.

20—Levelling. Precise Levelling in Ontario North of Parry Sound.

21—Levelling. Precise Levelling in Manitoba.

22—Levelling. Precise Levelling in Saskatchewan.

23—Levelling. Precise Levelling in Alberta.

24—Levelling. Precise Levelling in British Columbia.

25—The Conversion of Latitudes and Departures of a Traverse to Geodetic Differences of Latitude and Longitude.

26—The Simultaneous Adjustment of Precise Traverses and Triangulation Nets.

27—The Differential Adjustment of Observations.

28—Adjustment of Precise Level Net of Canada, 1928.

29—Triangulation in Southwestern Ontario.

30—Triangulation in New Brunswick and Nova Scotia.

31—Triangulation in Quebec and New Brunswick.

32—Triangulation in New Brunswick and Prince Edward Island.

33—Triangulation in Eastern Nova Scotia, Magdalen Islands.

34—Triangulation in Quebec.

35—Triangulation Closure in the Maritime Provinces.

36—Deflection of the Plumb Line in Canada.
Report of the Operations of the Geodetic Survey of Canada, April, 1912, to March, 1922, prepared by the Director for the First General Assembly of the International Geodetic and Geophysical Union held at Rome, 1922. (Bound with the Reports of the Section of Geodesy of the International Geodetic and Geophysical Union, 1922.)

Report of the Operations of the Geodetic Survey of Canada, April, 1922, to March, 1924, prepared by the Director for the Second General Assembly of the International Geodetic and Geophysical Union held at Madrid, 1924.

Report of the Operations of the Geodetic Survey of Canada, April, 1924, to December, 1926, prepared by the Director for the Third General Assembly of the International Geodetic and Geophysical Union held at Prague, 1927.

37—Geodetic Operations in Canada—January 1, 1927, to December 31, 1929. Reports of the Section of Geodesy—The International Geodetic and Geophysical Union, Fourth General Conference, Stockholm, 1930.

38—Precise Levelling on Vancouver Island.

47—Altitudes in Saskatchewan, South of Latitude $50^{\circ} 31'$.
Annual Report of the Superintendent of the Geodetic Survey of Canada for the fiscal year ending March 31, 1918. The same for the year 1922.
Annual Reports of the Director of the Geodetic Survey of Canada for the fiscal years 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933.

53—Geodetic Operations in Canada—January 1, 1930, to December 31, 1932. Reports of the International Association of Geodesy. The International Geodetic and Geophysical Union, Fifth General Conference, Lisbon, 1933.
Where name and number (or year) are omitted, the publication is not available for distribution.

Copies of the above publications may be obtained by applying to the Director of the Geodetic Survey of Canada, Department of the Interior, Ottawa.

